



## Course Syllabus: Seismic Imaging - ErSE 260

<b>Division</b>	Physical Science and Engineering Division
<b>Course Number</b>	ErSE 260
<b>Course Title</b>	Seismic Imaging
<b>Academic Semester</b>	Spring
<b>Academic Year</b>	2016/2017
<b>Semester Start Date</b>	01/22/2017
<b>Semester End Date</b>	05/18/2017
<b>Class Schedule</b> (Days & Time)	01:00 PM - 02:30 PM   Mon Wed

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Tariq Ali Alkhalifa	tariq.alkhalifah@kaust.edu.sa	+966128080282		Monday & Wednesday 03:00pm - 04:00pm

Teaching Assistant(s)	
Name	Email
Nabil Masmoudi	nabil.masmoudi@kaust.edu.sa

Course Information	
<b>Comprehensive Course Description</b>	We introduce the concept of seismic imaging in the framework of wavefield extrapolation and the imaging condition. We look at the various migration methods including Kirchhoff, phase-shift migration, Downward continuation methods, reverse time migration and others. We look at the impact of velocity and the role of imaging in estimating the velocity model.
<b>Course Description from Program Guide</b>	This course is devoted to studying the concept of seismic imaging for exploration purposes. We introduce seismic imaging in the framework of Greens functions and wavefield extrapolation and discuss the various imaging conditions. We look at the various migration methods including Kirchhoff, phase-shift migration, Downward continuation methods, reverse time migration, and others. We discuss the role that velocity plays in the seismic imaging process.

<b>Goals and Objectives</b>	<p>To understand and learn the fundamentals of seismic imaging and physical and mathematical framework behind its many concepts. with objectives to learn:</p> <ul style="list-style-type: none"> <li>-Wave propagation</li> <li>-High frequency asymptotics.</li> <li>-The concept of Seismic imaging.</li> <li>-Integral migration methods.</li> <li>-Fourier-based methods.</li> <li>-Prestack depth migration.</li> <li>-The role of velocity.</li> <li>-The double square formulation.</li> <li>-Sage</li> </ul>
<b>Required Knowledge</b>	Seissmology 1 and reasonable math, specifically PDE and linear Algebra
<b>Reference Texts</b>	<p>Class notes (CN) + Theory of Seismic Imaging (TSI) by John Scales The book can be downloaded freely from Samizdat Press <a href="http://samizdat.mines.edu/imaging/">http://samizdat.mines.edu/imaging/</a> <b>Additional References:</b> <i>Imaging the Earth Interior</i> by Jon Claerbout can be downloaded freely from <a href="http://sepwww.stanford.edu/sep/prof/iei/toc.html/">http://sepwww.stanford.edu/sep/prof/iei/toc.html/</a></p>
<b>Method of evaluation</b>	<p><b>50.00%</b> - Homework /Assignments <b>15.00%</b> - Midterm exam <b>35.00%</b> - Final exam</p>
<b>Nature of the assignments</b>	<p>Exams will represent 50% of the final course grade. There will be one midterm exam and one (final) exam in the lecture part of the course. Homework and a final project will represent the remaining 50% of the final course grade and will consist of a series of homework exercises designed to help you learn the essence of seismic imaging. Individual homework exercises (10%) will be designed to complement our progress in class and it will include codes to achieve parts of what learned. These exercises are preparatory for the understanding of the concept that is compiled into a final formally written report (40%) that will be submitted at the end of the course.</p>
<b>Course Policies</b>	Late homework submissions -20% of the homework grade up to a week after the deadline.
<b>Additional Information</b>	

## Tentative Course Schedule

*(Time, topic/emphasis & resources)*

Week	Lectures	Topic
1	Mon 01/23/2017 Wed 01/25/2017	Introduction to Seismic Imaging CN-Chapt1, TSI(p1-5)
2	Mon 01/30/2017 Wed 02/01/2017	Wavefields and Wave propagation CN-Chapt2
3	Mon 02/06/2017 Wed 02/08/2017	Wavefields to Wavefronts CN-Chapt3, TSI(p77-88)
4	Mon 02/13/2017 Wed 02/15/2017	Modeling in time and frequency CN-Chapt4
5	Mon 02/20/2017 Wed 02/22/2017	Modeling and the forward problem-exploding reflector CN-Chapt4, TSI(p7-9, p91-94)
6	Mon 02/27/2017 Wed 03/01/2017	The concept of seismic imaging- the adjoint and the imaging condition CN-Chapt5, TSI(p98-101)
7	Mon 03/06/2017 Wed 03/08/2017	Integral Imaging methods - Kirchhoff CN-Chapt6, TSI(p115-118)
8	Mon 03/13/2017 Wed 03/15/2017	Time migration and Zero-offset to Prestack CN-Chapt7, TSI(chapt.8, p111-114)
9	Mon 03/20/2017 Wed 03/22/2017	Imaging in the Fourier domain - <b>Midterm Exam</b>
10	Mon 03/27/2017 Wed 03/29/2017	Wave equation methods and Downward continuation CN-Chapt9, TSI(p119-126)
11	Mon 04/03/2017 Wed 04/05/2017	Spring Break
12	Mon 04/10/2017 Wed 04/12/2017	Reverse time migration (RTM) CN-Chapt10, TSI(p183-188)
13	Mon 04/17/2017 Wed 04/19/2017	The DSR formulation and Wide and the velocity issue CN-Chapt12
14	Mon 04/24/2017 Wed 04/26/2017	The velocity issue, image/angle gathers and waveform inversion CN-Chapt11
15	Mon 05/01/2017 Wed 05/03/2017	Imaging issues CN-Chapt12
16	Mon 05/08/2017 Wed 05/10/2017	Review-Migration velocity analysis issues
17	Mon 05/15/2017 Wed 05/17/2017	Final Exam
18		

### Note

The instructor reserves the right to make changes to this syllabus as necessary.